

CLAIMS

1. Operating device comprising:

- a substrate comprising an active surface
5 (Sa) that is substantially non-wetting with respect to a liquid of interest,
 - at least one zone (Zc) for the localized capture of a drop of said liquid of interest formed on said active surface,
 - 10 - at least one operating zone (Zt) arranged with the capture zone so that said capture zone surrounds the operating zone continuously or discontinuously, in such a way that the operating zone is at least partially covered by the drop of the liquid
15 of interest when said drop is captured by said capture zone,
 - means for supplying the liquid of interest that make it possible to leave a drop of said liquid of interest on said capture zone.

20 2. Device according to Claim 1, in which at least one capture zone has an open or closed shape chosen from an annular shape, a star shape, a rectangular shape, a square shape, a triangular shape, an elliptical shape, or a 4- to 20-sided polygonal
25 shape, and surrounds the at least one operating zone.

3. Device according to Claim 1, in which a capture zone for a drop of liquid of interest surrounds several working zones.

30 4. Device according to any one of the preceding claims, in which the capture zone is a zone

for the chemical, electrical or physical capture of a drop of liquid of interest.

5 5. Device according to Claim 1, in which the capture zone is a hollow in, or a projection on, the active surface making it possible to capture the drop by capillary forces.

6. Device according to Claim 1, in which the at least one capture zone is an electrode for capture by wetting.

10 7. Device according to Claim 1, in which the at least one capture zone consists of black silicon.

8. Device according to Claim 1, in which the at least one capture zone is an electrode for capture by electrowetting.

15 9. Device according to Claim 6, in which the electrodes captured by wetting consists of a material chosen from the group consisting of the noble metals, of noble metal alloys, of carbon, of graphite, and of ITO, said material being rendered wetting by
20 electrodeposition onto the latter of an electrically conducting polymer to which a chemical function that is wetting with respect to the liquid of interest is attached.

25 10. Device according to Claim 1, in which the capture zone consists of a material rendered wetting by grafting onto the latter of a chemical function that is wetting with respect to the liquid of interest.

30 11. Device according to Claim 10, in which the material is chosen from the group consisting of silicon, silicon oxide, glass, silicon nitride and organic polymers; and of a metal or of a metal alloy.

12. Device according to Claim 11, in which the grafting onto the material is carried out by silanization with a silane bearing the wetting chemical function.

5 13. Device according to Claim 6, in which the electrode for capture by wetting is a gold electrode rendered wetting by physisorption of a thiol to which a chemical function that is wetting with respect to the liquid of interest is attached.

10 14. Device according to any one of Claims 9 to 13, in which, since the liquid of interest is aqueous, the chemical function that is wetting with respect to the liquid of interest is chosen from the group consisting of an alcohol, alkoxide, carboxylic acid,
15 carboxylate, sulphonic acid, sulphonate, oxiamine, hydrazine, amine and ammonium function.

 15. Device according to Claim 1, in which, since the liquid of interest is aqueous, the at least one capture zone is a hydrophilic zone and the
20 substantially non-wetting active surface is hydrophobic.

 16. Device according to any one of the preceding claims, in which the capture zone and the operating zone(s) arranged with it can be placed in a
25 hollow or on a projection relative to the active surface.

 17. Device according to any one of the preceding claims, in which the at least one operating zone is a zone of electrical and/or chemical
30 interaction with said drop of liquid of interest captured.

18. Device according to Claim 17, in which the at least one operating zone is an electrochemical microcell.

5 19. Device according to any one of Claims 1 to 18, in which the at least one operating zone is a zone for detection of at least one chemical or biological species that may be present in the drop of liquid of interest when it is captured.

10 20. Device according to any one of Claims 1 to 18, in which the at least one operating zone is a zone functionalized with a probe intended to interact with a target that may be present in the drop of liquid of interest when it is captured.

15 21. Device according to Claim 18 when it depends on any one of Claims 6, 9 to 14, in which the electrode for capture of a drop of liquid of interest by wetting is also used as an electrode for the operation of the electrochemical microcell of the operating zone.

20 22. Device according to Claim 17 or 18 when it depends on Claim 9, in which the electrode for capture of a drop of liquid of interest by wetting is also used as an electrode for the operation of the electrochemical microcell of the operating zone, and in
25 which said electrode is functionalized with a probe intended to interact with a target that may be present in the drop of liquid of interest.

30 23. Device according to Claim 22, in which the probe is attached to the electrically conducting polymer bearing a wetting function.

24. Device according to Claim 9, 22 or 23, in which the electrically conducting polymer is chosen from the group consisting of polypyrrole, polyaniline, polyazulene, a polythiophene, a polyindole, a polyfuran
5 and a polyfluorene.

25. Device according to any one of Claims 20, 22 to 24, in which the probe is chosen from the group consisting of an enzyme, an enzyme substrate, an oligonucleotide, an oligonucleoside, a protein, a
10 membrane receptor of a eukaryotic or prokaryotic cell, an antibody, an antigen, a hormone, a metabolite of a living organism, a toxin of a living organism, a polynucleotide, a polynucleoside and a complementary DNA.

15 26. Device according to any one of Claims 1 to 16, in which the at least one operating zone is a sensor chosen from the group consisting of optical, electrical, magnetic, electrostatic, mechanical, thermal and chemical sensors.

20 27. Device according to any one of Claims 1 to 16, in which the at least one operating zone is an actuator chosen from the group consisting of optical, electrical, magnetic, electrostatic, mechanical, thermal and chemical actuators.

25 28. Device according to Claim 1, in which the at least one operating zone is a zone that is substantially non-wetting with respect to the liquid of interest.

30 29. Device according to any one of the preceding claims, in which the active surface is a surface consisting of a material chosen from the group

consisting of silicon; silicon oxide; glass; silicon nitride; an organic polymer; a metal or a metal alloy.

30. Operating plate comprising several identical or different operating devices according to
5 any one of Claims 1 to 29.

31. Operating plate according to Claim 30, in which the operating devices form an array.

32. Device according to any one of Claims 1 to 29, or plate according to Claim 30 or 31, in which the
10 means for leaving a drop of liquid of interest on said localized capture zone is a dispenser of a drop of liquid of interest per capture zone.

33. Operating box comprising:

- a container comprising means for the
15 introduction of a liquid of interest into the container and for the withdrawal of liquid of interest from the container,

- an operating device according to Claim 1, or a plate according to Claim 30 or 31, placed in said
20 container,

the means for the introduction and for the withdrawal of the liquid of interest into and from the container being arranged in such a way that, when the liquid of interest is introduced into the container, it
25 covers the at least one capture zone(s), and then, when the liquid of interest is withdrawn from the container, a drop of liquid of interest remains captive by virtue of said capture zone.

34. Operating box according to Claim 33, in
30 which the means for the extraction of the liquid of interest from the container consist of a pump for

injection of a gaseous fluid via an inlet opening so as to withdraw the liquid of interest by driving it from the container via an outlet opening.

35. Operating box according to Claim 34, in
5 which the pump for injection of the gaseous fluid via the inlet opening of the container comprises a device for saturating the gaseous fluid injected with vapour of the liquid of interest.

36. Operating box according to Claim 33, in
10 which the means for the withdrawal of liquid of interest from the container consist of a suction pump placed so as to withdraw the liquid of interest from the container by suctioning it.

37. System comprising one or more operating
15 device(s) according to any one of Claims 1 to 29, or a plate according to Claim 30 or 31.

38. System comprising an operating box according to any one of Claims 33 to 36.

39. Biological chip comprising an operating
20 device according to any one of Claims 1 to 29, or a plate according to Claim 30 or 31.

40. Biological chip according to Claim 39, said chip being chosen from the group consisting of nucleic acid chips, antibody chips, antigen chips, protein
25 chips and cell chips.

41. Box comprising a biological chip according to Claim 39 or 40.

42. Method for the fabrication of a device according to Claim 1, said method comprising the
30 following steps:

- providing a substrate comprising a surface chosen to become the active surface,
- structuring the chosen surface of the substrate in order to form thereon an operating zone,
- 5 - applying a treatment to the chosen surface in order to render it substantially non-wetting with respect to the liquid of interest for which the device is intended, and
- 10 - structuring the chosen surface in order to form a capture zone for a drop of liquid of interest,
- 15 the steps consisting in structuring the surface so as to form an operating zone and in structuring the surface so as to form the capture zone being carried out such that the operating zone is arranged with the capture zone so that the capture zone surrounds the operating zone continuously or discontinuously in such a way that, when the capture zone captures a drop of liquid of interest, the operating zone is at least partially covered by said drop.